INTRODUCTION.

- Kidney failure also known as renal failure is the partial or complete impairment of kidney function. It result in an inability to excrete metabolic waste products and water, and it contributes to disturbances of all body system.
- The term uremic syndrome and renal failure are used synonymously. The term uremic syndrome describes a set of manifestations that result from loss of renal function.

ACUTE KIDNEY INJURY.

- Acute kidney injury is a syndrome characterized by-
- Sudden decline in GFR(hours to day)
- Retention of nitrogenous wastes product in blood(Azotemia).
- Disturbance in extracellular fluid volume
- Disturbance in electrolyte and acid base homeostasis.

CHRONIC RENAL FAILURE.

- CKD is defined as abnormalities of kidney structure or function , present for > 3 month.
- Markers of kidney damage
- Albuminuria
- Electrolyte and other abnormalitiesdue to tubular disorder.
- GFR < 60mL/min/1.72m2 for > 3 month.

ETIOLOGY.

- ***Glomerular disease***
- Diabetes
- Autoimmune disease
- Systemic infection
- Drug
- Vascular disease
-

- ***Atherosclerosis***
- Hypertension
- Ischemia

obstruction

Stone

Cystic disease

polycystic kidney disease.

Leading cause of CKD.

- Diabetic nephropathy
- Glomerulonephritis
- Hypertension
- Autosomal dominant polycystic kidney disease
- Cystic nephropathy.

Pathophysiology of CKD

- Genetically determined abnormalities in kidney
- Immune complex deposition and inflammation in certain type of glomerulonephritis.
- Toxin exposure
- Hyperfilteration and Hypertrophy of remaining nephrons.

NEPHRON-Functional unit of kidney.

- EACH NEPHRON CONTAINS-
- 1. Glomerulus- tuft of glomerular capillaries through which large amount of fluid filtered from the blood.
- 2. Long tubule-
- Filtered fluid is converted into urine on its way to pelvis of the kidney.
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Function of kidney.

- 1.Excretion of metabolic waste product.
- 2.Regulation of water and electrolyte balance.
- 3.Regulation of body fluid osmolality and electrolyte concentration.
- 4.Regulation of arterial pressure.
- 5.Regulation of acid base balance.
- 6.Secretion, metabolism and excretion of hormones.
- 7.Gluconeogenesis.

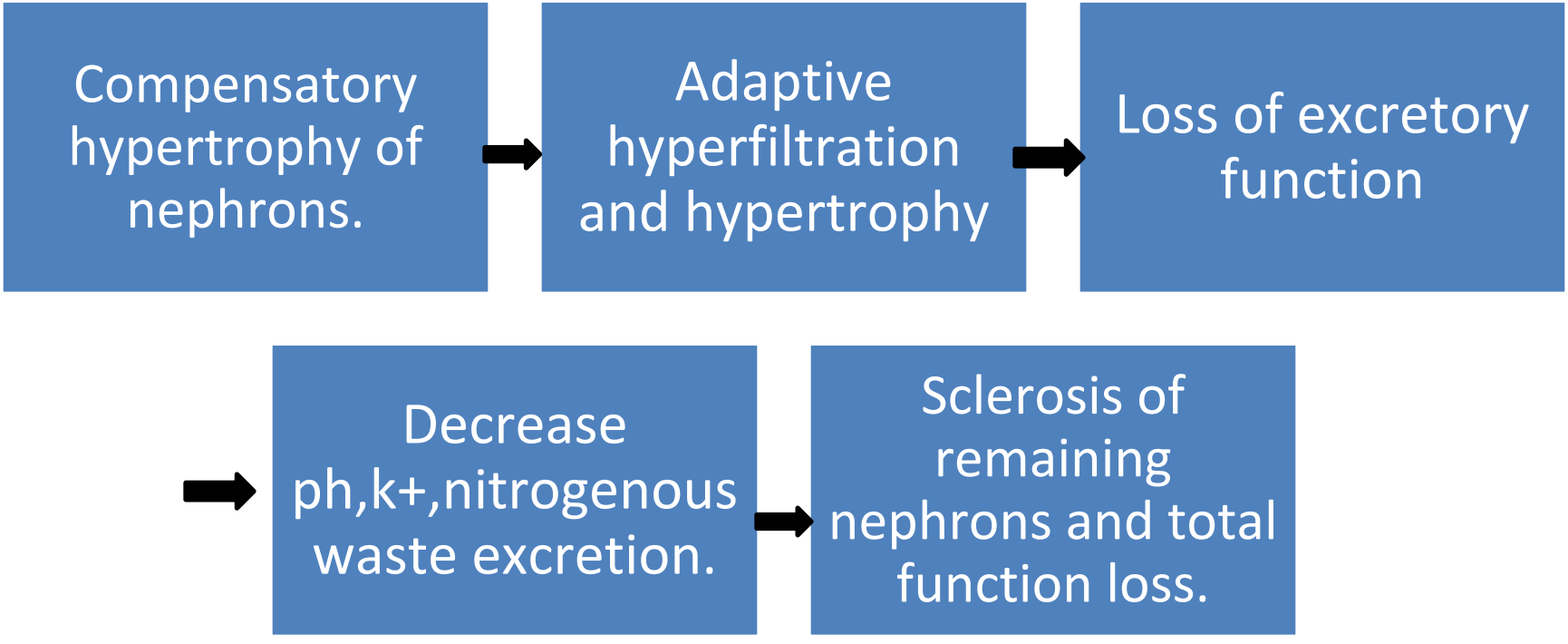
STAGES OF CKD.

- **Stage 1—**
- GFR> 90ml/min, kidney damage with normal or increase GFR.
- Stage 2—
- mild reduction(GFR 60-89ml/min)
- GFR of 60 may represent 50% loss in function.
- Stage 3-
- Moderate reduction(GFR 30-59)
- Stage 4-
- severe reduction(GFR 15-29)
- Stage 5-
- kidney failure(GFR < 15 ml/min), End stage kidney diseae.

UREMIA

- Those consequent to the accumulation of toxins that normally undergo renal excretion , including product of protein metabolism.
- Those consequent to the loss of other kidney function , such as fluid and electrolyte homeostasis and hormone regulation.
- Progressive systemic inflammation and its vascular and nutritional consequences.

Pathophysiology.



- Hundreds of toxins that accumulate in renal failure have been implicated in the uremic syndrome.
- These include water soluble, hydrophobic, protein bound charged and uncharged compounds.
- Nitrogenous excretory product includes guanidino compounds, urates, hippurates, product of nucleic acid metabolism, etc....

Laboratory finding.

- Elevated BUN and creatinin.
- ↓GFR
- Hyperkalemia
- Hyponatremia
- Acidosis
- Hypocalcemia
- Hyperphosphatemia
- Elevated uric acid
- Hypoproteinemia
- Normocytic normochromic anemia
- Hematuria and proteinuria(Glomerulonephritis.)

Classification of KFT.

- **1.To screen for kidney disease.**
- Complete urine analysis
- Plasma urea and creatinine
- Plasma electrolyte

- **2.To asses renal function**
- A.To assess glomerular function-
- Glomerular filteration rate- clearance test
- Glomerular permeability- proteinurea
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- B.To assess tubular function
-
- specific gravity
- Reabsorption and secretion
- Concentration and dilution tests
- Renal acidification.

Blood Biochemistery.

- Two biochemical parameters are commonly used to assess renal function.
- 1.blood urea nitrogen.
- 2.serum creatinine.
- Insensitive marker of glomerular function.

CAUSES OF INCREASED BUN

- 1.Pre- renal azotemia-
- shock, CHF, salt and water depletion.
- 2.Renal azotemia—
- impairment of renal function.
- 3.Post- renal azotemia-
- obstruction of urinary tract.
- 4. Increaed rate of production of urea-
- High protein diet.
- Increased protein catabolism.
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Serum creatinine.

- Creatinine is a nitrogenous waste product formed in muscle from creatine phosphate.
- Serum creatinine is a more specific and more sensitive indicator of renal function as compared to BUN.

Blood urea nitrogen(BUN).

- Urea = BUN x (60/28). Urea = BUN x 2.14
- Normal BUN is 10-18 mg/dl.
- Increased BUN or Urea ---Azotemia.
- Azotemia—
- Retention of nitrogenous waste products excreted by kidney. It is either due to increased protein catabolism or impaired kidney function.

Test to assess Glomerular injury/ integrity.

- Endothelial cell-- impermeable to RBC.
- Glomerular BM – impermeable to Albumin.

- NORMAL URINARY PROTEIN EXCRETION–

- Less than 150 mg/24 hours. Made up of mostly albumin, Tamm Horsfall glycoprotein and alpha-1-microglobulin.

- Albuminurea - always pathological.
- Proteinurea in urine is an indicator of leaky glomeruli.

- The glomerulus act as a selective filter of the blood passing through capallaries.
- Urea, glucose, creatinine, electrolyte are freely filtered.
- Urinary concentration of proteins depend on the permeability of glomerular membrane and the reabsorptive capacity of PCT.
- 90 % of the filtered protein are reabsorbed by healthy kidney.

PROTEINUREA.

- First sign of glomerular injury, before ↓in GFR.
- ↑Glomerular permeability- smaller molecule of albumin pass through damaged glomeruli more readly than the heavier globulins—NEPHROTIC SYNDROME.
- ↓Tubular reabsorption- Retinal binding protein(RBP) and alpha-1- microglobulins in urine increased.
- Oveflow proteinurea- SMW protein are increase in bloods, they overflow into urine.
- Bens-jones protein—Multiple myeloma.

PROTEINUREA.

- Nephron loss proteinurea—
- occurs when functional nephrons are reduced GFR is increased and remaining nephrons are overworking.
- Urogenic proteinurea—
- Due to inflammation of lower urinary tract, when proteins are secreted into tracts.

Microalbuminurea/minimal albuminurea/paucialbuminurea.

- Small amount of Albumin is excreted 30-300/day.
- Early indicator of nephroppathy.
- Is an indicator of future renal failure.
- It ia expressed as albumin-creatinine ratio.

Specific gravity

- Simplest test.
- Index of concentrating ability of tubules.
- Increased sp.gravity----dehydration, DM.
- Decreased sp.gravity----renal failure.
- Fixed sp.gravity—1.010-ISOSTHENURIA—CRF.
- OSMOLALITY—
- Plasma osmolality 285-300 mosm/kg.
- Osmolality is measured by osmometer and based on the depression of Freezing point.

PRESENTING MANISFESTATION.

- **SYMPTOM AND SIGN-**-
- Decreased or no urine output.
- Flank pain
- Edema
- Hypertension
- Discolored urine-Hematuria, pus in urine.
- Anemia.
- Weakness, Anorexia, Nausea and vomiting.

Clinical manifestation.

- Failure of kidneys to remove excess fluid may cause–
- Edema of leg, ankle, feet, face or hand.
- Shortness of breath due to extra fluid on the lung.
- METABOLIC CHANGES–
- An increase in serum creatinine or BUN.
- High level of urea in the blood , which can result in
- Vomiting or diarrhoea leads to dehydration.
- Azotemia and ultimately uremia.

Alteration in fluid and Electrolytes.

- Sodium and water retention
- fluid movement into extravascular space---edema in lower extremity—swelling—generalized edema.
- Fluid accumulation----
- pulmonary edema and loss of space—ventilation perfusion mismatch- shortness of breath—pulmonary crackles.

Water and Electrolyte disorder.

- Kidney damage—inability to secrete potasium in the urine----HAPERKALEMIA----Palpitation—Arrthymias.
- **ANEMIA—**
- Loss of Erythropoitin release—Anemia—Fatigue,pallor.

Complication of uremia.